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Fast-Tracks and Prizes: A Multi-Pronged Approach to Incentivizing Green Technology Innovation

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FAST-TRACKS AND PRIZES: A MULTI-PRONGED APPROACH TO INCENTIVIZING GREEN TECHNOLOGY INNOVATION

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Abstract: Faced with the ever-worsening climate crisis, many nations—including the United States—have increasingly recognized the urgent need for rapid advancements in green, clean, and sustainable technologies. Patents play a fundamental role in incentivizing technological innovation, but the traditional patent process is too slow to match the urgency of the climate crisis. At the same time, the marketplace significantly undervalues green technology patents because they confer benefits to third parties not involved in the transaction (referred to as "positive externalities"). To address the urgency issue, patent "fast-track" programs have been implemented to speed up the patent application review process. To mitigate the positive externality issue, scholars have suggested patent prize systems may compensate for market failure. This Comment analyzes the green technology fast-track programs in the United States and proposes a method of combining the patent system with an "inventor's choice" prize system to leverage the advantages of both systems to drive green technology innovation.

INTRODUCTION

The 26th Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change took place in November 2021.[1] The conference addressed the unyielding urgency of the global climate crisis.[2] Building on the already-ambitious goal of limiting global

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1. Helen Mountford, David Waskow, Lorena Gonzalez, Chirag Gajjar, Nathan Cogswell, Mima Holt, Taryn Fransen, Molly Bergen & Rhys Gerholdt, *COP26: Key Outcomes from the UN Climate Talks in Glasgow*, WORLD RES. INST. (Nov. 17, 2021), https://www.wri.org/insights/cop26-key-outcomes-un-climate-talks-glasgow [https://perma.cc/LGP4-VK28].

2. *Id.* For a discussion on how climate change has already manifested as various global crises, see generally U.S. GLOB. CHANGE RSCH. PROGRAM, 1 EXECUTIVE SUMMARY OF CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 1–2 (Donald J. Wuebbles et al. eds., 2017), https://science2017.globalchange.gov/downloads/CSSR2017_PRINT_Executive_Summary.pdf [https://perma.cc/GEG8-6DRP] (discussing, *inter alia*, how the global average air temperature has increased 1.8 degrees Fahrenheit, the global average sea level has risen about seven to eight inches since 1900 with almost half of that rise occurring since 1993, and in the United States, heatwaves have become more frequent, extreme cold has become less frequent, and the incidence of large forest fires has increased since 1980).

warming to 1.5 degrees Celsius established in the 2015 Paris Agreement,[3] 151 countries committed to aggressively cut carbon emissions to achieve net-zero carbon emissions by 2030.[4] In addition to participating in COP26, the United States recognized the urgency of the climate crisis by committing to reduce greenhouse gas emissions by as much as fifty-two percent over the next decade.[5]

Many actors in the private sector are also starting to commit to climate action. A survey of more than 4,000 large entities—including all nations, all states and regions in the twenty-five highest-emitting countries, and all companies in the Forbes Global 2,000 list—revealed that nineteen percent of them have a net-zero emissions target in place.[6] Recognizing that achieving these net-zero targets in just the next few decades requires significant innovation, the clean technology sector has experienced an "investment boom" over the last several years.[7]

There are no standard definitions for "clean" or "green" technologies, and these terms have been used to refer to a broad swath of technological sectors.[8] Generally, these terms indicate technologies that attempt to

3. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104; *see, e.g.*, *id.* at 3–4 ("In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emission as soon as possible . . . and to undertake rapid reductions thereafter . . . so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.").

4. Mountford et al., *supra* note 1.

5. Press Release, White House Briefing Room, Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/ [https://perma.cc/H59F-3DXY].

6. Richard Black, Kate Cullen, Byron Fay, Thomas Hale, John Lang, Saba Mahmood & Steve Smith, *Taking Stock: A Global Assessment of Net Zero Targets*, ENERGY & CLIMATE INTEL. UNIT 5–6 (2021), https://ca1-eci.edcdn.com/reports/ECIU-Oxford_Taking_Stock.pdf?v=1616461369 [https://perma.cc/R2WX-6VS3].

7. Myles McCormick, *Urgency over Net Zero Sparks Climate Tech Investment Boom*, FIN. TIMES (Oct. 31, 2021), https://www.ft.com/content/38b041e9-18f1-4eee-99fa-8de627bf9975 [https://perma.cc/T27X-YA7M] (discussing a record $17 billion in venture capital in the clean technology sector in 2020).

8. Tabrez Y. Ebrahim, *Clean and Sustainable Technology Innovation*, 45 CURRENT OP. ENV'T SUSTAINABILITY 113, 113–14 (2020) ("[C]lean technology has been defined by the United Nations as energy-generating technologies that have the potential for reducing greenhouse gases. Clean technology refers to measures taken to reduce or eliminate at the source of production any nuisance, pollution, or waste, and to help save raw materials, natural resources, and energy, thereby increasing performance, productivity, or efficiency by minimizing negative effects on the environment. Sustainable technology refers to the design of chemical products that offer environmentally friendly alternatives; these sustainable technologies can either prevent waste, are less toxic, use renewable

minimize environmental damage, reduce greenhouse gases, conserve natural resources, increase energy efficiency, reduce pollution and toxic waste, facilitate renewable energy production, or otherwise improve the environment.[9] These technologies are relevant to a host of urgent societal concerns, including combating the effects of climate change,[10] reducing food insecurity,[11] expanding rural access to electricity,[12] facilitating rural and national economic growth,[13] expanding military capabilities,[14] and reducing international energy dependency.[15] Broadly speaking, these technologies can encompass both high- and low-tech innovations,[16] and

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feedstock, use safer solvents and reaction conditions, or increase energy efficiency."). Other common terms include "alternate energy," "cleantech," and "green" technologies. *Id.* at 113; *see also* Maria Urbaniec, Justyna Tomala & Sergio Martinez, *Measurements and Trends in Technological Eco-Innovation: Evidence from Environment-Related Patents*, RESOURCES, June 28, 2021, at 1, 3, https://www.mdpi.com/2079-9276/10/7/68# [https://perma.cc/Z86A-4HMM] (discussing the term "eco-innovation" as a "synonym for ecological innovation, environmental innovation, green innovation, sustainable innovation, sustainability-driven innovation, sustainability-enhancing innovation and sustainability-oriented innovation, and includes different technologies (e.g., solar or wind energy systems), organizational practices (e.g., pollution prevention) and services (e.g., electric roads)"). This Comment will use these terms interchangeably throughout.

9. Ebrahim, *supra* note 8.

10. *See., e.g.*, *Climate Change Impacts*, NOAA (last updated Aug. 13, 2021), https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts [https://perma.cc/L3CN-AW2C] ("Changes in weather and climate patterns can put lives at risk. Heat is one of the most deadly weather phenomena. As ocean temperatures rise, hurricanes are getting stronger and wetter, which can cause direct and indirect deaths. . . . Higher incidences of flooding can lead to the spread of waterborne diseases, injuries, and chemical hazards. . . . [T]hese changes are happening too fast for many . . . plants and animals as increasing temperatures and changing precipitation patterns stress ecosystems.").

11. U.N. Conf. on Trade & Dev., *The Impact of Rapid Technological Change on Sustainable Development*, at 3–4, U.N. Doc. UNCTAD/DTL/STICT/2019/10 (Feb. 17, 2020), https://unctad.org/system/files/official-document/dtlstict2019d10_en.pdf [https://perma.cc/LAS4-VUZB].

12. *Id.* at 5–6.

13. *Id.*

14. David Alexander, *'Great Green Fleet' Using Biofuels Deployed by U.S. Navy*, REUTERS (Jan. 20, 2016, 5:27 PM), https://www.reuters.com/article/us-usa-defense-greenfleet/great-green-fleet-using-biofuels-deployed-by-u-s-navy-idUSKCN0UY2U4 [https://perma.cc/E25E-DZGE].

15. Sarah Tran, *Expediting Innovation*, 36 HARV. ENV'T L. REV. 123, 129–31 (2012).

16. Bronwyn H. Hall & Christian Helmers, *The Role of Patent Protection in (Clean/Green) Technology Transfer*, 26 SANTA CLARA HIGH TECH. L.J. 487, 510 (2009) ("The underlying technology behind green innovations differ greatly, and range from high-tech innovations such as genetically modified crops to low-tech innovations such as mechanical farming techniques."). The definition of high- and low-technology is highly variable. *See* Thibaut Faucon & Anne-Charlotte Bonjean, *What Do We Mean by "Low-Tech"?*, OECD F. NETWORK (June 1, 2022), https://www.oecd-forum.org/posts/what-do-we-mean-by-low-tech [https://perma.cc/PBR9-NVVK] ("The term 'low-tech' . . . has no common definition."); Hall & Helmers, *supra* note 16, at 497 (providing examples of high-tech including "pharmaceuticals, chemicals, and office and telecom equipment."). This Comment will simply use high- and low-tech as very general shorthand for more-complex and less-complex inventions.

range from biotechnology innovations such as algae biofuels to mechanical engineering-based carbon capture and storage mechanisms.[17]

Given the urgency of the climate crisis, many governments, businesses, and legal scholars have explored adapting national patent systems to facilitate green technology innovation.[18] Patents have long been considered an effective mechanism for incentivizing innovation,[19] and many nations—including the United States—have created targeted programs, statutes, and regulations to shorten the time for green technology patents to issue.[20] By shortening the application process, inventors may enjoy the exclusivity benefits of patent protection for longer than through the normal process,[21] and society would benefit from the rapid disclosure of environmentally-friendly technologies.[22] Perhaps counterintuitively, inventors have not participated in these programs at a high level.[23]

One of the issues that may be driving this low participation is that patents are relatively ineffective at incentivizing green technologies.[24] Patent systems fail to fully capture the value of technologies that confer substantial benefits to third parties, which undercuts demand for such technologies.[25] Because market demand is the primary driver of a patent's value, green technologies are at an inherent disadvantage due to the presence of these market dynamics—called "positive externalities."[26] In a

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17. Neasa MacErlean, *Top 10 Clean Technology Breakthroughs*, GUARDIAN (Oct. 18, 2011, 4:00 AM), https://www.theguardian.com/sustainable-business/clean-technology-100-renewable-energy-solutions [https://perma.cc/H3EV-HXRP].

18. Ebrahim, *supra* note 8, at 113 ("To meet the challenges posed by climate change . . . [b]usinesses and governments have embarked on initiatives to develop clean technology and sustainability solutions in recent years. Legal scholars and economies have studied a variety of innovation mechanisms, including patents, prizes, grants, and tax credits . . . . Patents have been considered as effective inducements to innovative activity.").

19. *See* Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1576 (2003) ("Patent law is our primary policy tool to promote innovation, encourage the development of new technologies, and increase the fund of human knowledge.").

20. *See, e.g.*, 37 C.F.R. § 1.102(c) (2021) ("A petition to make an application special may be filed without a fee if the basis for the petition is . . . [t]hat the invention will materially . . . [e]nhance the quality of the environment.").

21. This is because the exclusivity period for a patent (i.e., the patent "term") is calculated from the filing date of the patent application, rather than the issue date of the patent. 35 U.S.C. § 154(a)(2).

22. *See infra* section I.A.

23. Antoine Dechezleprêtre & Eric Lane, *Fast-Tracking Green Patent Applications*, WIPO MAG. (June 2013), https://www.wipo.int/wipo_magazine/en/2013/03/article_0002.html [https://perma.cc/EDK3-ZZW6] ("For most programs, a very small share of eligible patent applications was submitted under the accelerated procedures.").

24. Ofer Tur-Sinai, *Patents and Climate Change: A Skeptic's View*, 48 ENV'T L. 211, 214 (2018).

25. *Id.*

26. *Id.*

study comparing the number of environment-related patent applications under the Patent Cooperation Treaty (PCT)[27] with various indicators of "eco-innovation,"[28] the share of environment-related patents to total patent applications, the number of environment-related patents per capita, and the number of environment-related patents per $100 billion in Gross Domestic Product (GDP) declined from 2013 to 2017 (the final year evaluated by the study).[29] This is concordant with research from the International Energy Agency (IEA) that found that patents of technologies related to power generation, transport, buildings, manufacturing, and carbon capture and storage steadily declined from 2012 to 2018, and that there was no indication these trends would change in the near future.[30] In that same period, there was no decrease in patents generally, or in other fields such as health technologies, general engineering, or information and communication technologies.[31]

To counter the problem of positive externalities, patent prize systems have been put forward[32] as a means of accounting for an invention's social value.[33] But though scholarly literature has called for patents and prizes to

27. For information on the PCT, see U.S. PAT. & TRADEMARK OFF., MPEP § 1800 (9th ed. Rev. 07.2022, Feb. 2023); *see also PCT FAQs*, WIPO (July 2022), https://www.wipo.int/pct/en/faqs/faqs.html [https://perma.cc/4YGK-FQB7] ("The PCT is an international treaty with more than 155 Contracting States. The PCT makes it possible to seek patent protection for an invention simultaneously in a large number of countries by filing a single 'international' patent application instead of filing several separate national or regional patent applications.").

28. Urbaniec et al., *supra* note 8 ("[Eco-innovation] is used as a synonym for ecological innovation, environmental innovation, green innovation, sustainable innovation, sustainability-driven innovation, sustainability-enhancing innovation and sustainability-oriented innovation, and includes different technologies (e.g., solar or wind energy systems), organizational practices (e.g., pollution prevention) and services (e.g., electric roads).").

29. *Id.* at 1, 7–9.

30. Miguel Rodriguez, Ivan Haščič & Nick Johnstone, *Global Patent Applications for Climate Change Mitigation Technologies—a Key Measure of Innovation—Are Trending Down*, INT'L ENERGY AGENCY (July 11, 2019), https://www.iea.org/commentaries/global-patent-applications-for-climate-change-mitigation-technologies-a-key-measure-of-innovation-are-trending-down [https://perma.cc/N6F9-K3YB].

31. *Id.*; *see also* Natalie Sauer, *Cleantech Patent Applications Plummet, Sparking Fears for Innovation*, CLIMATE HOME NEWS (July 16, 2019, 6:10 PM), https://www.climatechangenews.com/2019/07/16/cleantech-patent-applications-plummet-sparking-fears-innovation/ [https://perma.cc/JE4S-XNZ3] ("Applications plummeted 77% from a high of 1,256 in 2011 to 285 in 2018 in the power generation sector and 918 to 298 in buildings over the same period. The figure for transport peaked at 740 in 2014, slumping to 259 [in 2018]. Inventions related to carbon capture and storage and manufacturing were also down.").

32. Tur-Sinai, *supra* note 24, at 251.

33. *See id.* at 253–54.

work in tandem in the green technology sector,[34] the exact nature of how these two systems might interact has not been fully explored. Part I provides background on the role patents play in incentivizing innovation. Part II discusses the inability of the patent system to incentivize green technology innovation. Part III examines the failures of various patent fast-track programs, past and present, on spurring green technology innovation. Part IV proposes the reinstatement of an improved fast-track system that builds on the issues of prior systems. Part IV continues by proposing a green technology prize system designed to compensate for positive externalities that operates in tandem with the fast-track program via an "inventor's choice" certificate that is flexible enough to support innovation of a wide range of technologies.

I. HOW DO PATENTS INCENTIVIZE INNOVATION?

Patents are one tool the United States government uses to incentivize technological innovation. This Part begins by discussing generally how the United States patent system works, including the criteria inventions must meet to be eligible for a patent. It proceeds by briefly examining how patents create innovation incentives and introduces the weaknesses of the patent system with regard to certain technologies.

A. United States Patent Fundamentals

Patents are the principal mechanism through which inventors secure intellectual property protection for their inventions. Article I, Section 8 of the U.S. Constitution grants Congress the power to "promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[35] To this end, patents grant inventors "the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States."[36] On its face, a patent is a negative right—the right to exclude others from something—rather than an affirmative

34. *See* Jonathan H. Adler, *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*, 35 HARV. ENV'T L. REV. 1, 15 (2011) ("[T]he two need not be mutually exclusive. To the contrary, prizes and patent protection can be complimentary."); Tur-Sinai, *supra* note 24, at 251 ("In light of the patent system's shortcomings in the environmental domain, the analysis conducted in this Article supports increasing the use of other policy instruments for incentivizing innovation alongside the patent system.").

35. U.S. CONST. art. I, § 8, cl. 8.

36. 35 U.S.C. § 154(a)(1).

right to take a particular action.[37] In practice, however, a patent typically functions as a temporary government-granted monopoly that enables inventors (and investors) to recoup their effort and investment.[38] In exchange for a patent, an inventor agrees to disclose their invention to the public in sufficient detail such that a person of ordinary skill in the field could reproduce it.[39] Thus, society is granted the knowledge of the invention and the inventor is rewarded with a temporary commercial benefit.[40] Upon expiration of the patent term, the public gains unrestricted use of the patented technology.[41] In the United States, the typical patent term is twenty years.[42]

Obtaining a patent can be an expensive, time-consuming process.[43] After an inventor creates something they wish to patent, they must file a patent application with the patent office of each country in which they desire patent protection, subject to applicable consolidated processes created by international treaties.[44] Once an application is filed and the fee is paid, a patent examiner reviews the application to determine if the invention meets the various requirements for patentability.[45] Though highly variable, as of March 2023, the average time in the United States from application to first response (called an "office action") was about

37. *Cf. id.* ("Every patent shall contain . . . a grant to the patentee, his heirs or assigns, of the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States or importing the invention into the United States, and, if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States, or importing into the United States, products made by that process, referring to the specification for the particulars thereof.").

38. Gregory N. Mandel, *Promoting Environmental Innovation with Intellectual Property Innovation: A New Basis for Patent Rewards*, 24 TEMP. J. SCI. TECH. & ENV'T L. 51, 54 (2005).

39. 35 U.S.C. § 112.

40. Patrick Gattari, *The Role of Patent Law in Incentivizing Green Technology*, 11 NW. J. TECH. & INTELL. PROP. 41, 42 (2013) ("The patent is awarded as a quid pro quo for an inventor's disclosure of the invention in the patent.").

41. *Id.*

42. 35 U.S.C. § 154(a)(2).

43. Gene Quinn, *The Cost of Obtaining a Patent in the U.S.*, IPWATCHDOG (Apr. 4, 2015, 3:05 PM), https://www.ipwatchdog.com/2015/04/04/the-cost-of-obtaining-a-patent-in-the-us/id=56485/ [https://perma.cc/5GTC-UJ2P] (discussing how cost can vary dramatically based on the complexity of the technology and attorney's fees but provides estimates ranging from $12,080 to $22,880).

44. *See* U.S. PAT. & TRADEMARK OFF., MPEP § 1801 (9th ed. Rev. 07.2022, Feb. 2023) ("The Patent Cooperation Treaty (PCT) enables the U.S. applicant to file one application, 'an international application' . . . and have that application acknowledged as a regular national or regional filing in as many Contracting States to the PCT as the applicant 'designates.'"); *see also PCT FAQs*, *supra* note 27 (discussing how the Paris Convention of 1883 and Patent Cooperation Treaty (PCT) standardized certain filing requirements and streamlined the simultaneous filing of multiple national applications).

45. U.S. PAT. & TRADEMARK OFF., MPEP § 2103 (9th ed. Rev. 07.2022, Feb. 2023).

16.1 months,[46] and from application to patent issuance is approximately two to four years.[47] To reduce the processing time for certain technologies, the United States Patent and Trademark Office (USPTO) and Congress have instituted a number of accelerated examination programs that significantly reduce pendency.[48]

To qualify for a patent, an invention must meet five requirements: (1) the subject matter must be a process, machine, article of manufacture, composition of matter, or improvement of one of these categories;[49] (2) the invention must be useful;[50] (3) the invention must be novel;[51] (4) the invention must be properly disclosed and enabled;[52] and (5) the invention must be non-obvious.[53] The non-obviousness requirement means that an invention must be more than just new; it requires an invention to sufficiently advance the state of the art such that the grant of a patent monopoly would not unnecessarily stifle scientific progress.[54] In addition, courts have determined that under the subject matter requirement, an invention cannot be directed at mere abstract ideas, natural phenomena, and laws of nature, without adding additional elements that amount to "significantly more."[55]

Non-obviousness analysis is a highly fact-specific inquiry that turns on whether a person skilled in the art would have found the invention to be

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46. *Patents Pendency Data March 2023*, U.S. PAT. & TRADEMARK OFF. (last updated Apr. 2023), https://www.uspto.gov/dashboard/patents/pendency.html [https://perma.cc/3758-ASU7].

47. *Id.* In March 2023, average traditional total pendency was 25.6 months, and average pendency for applications that included at least one Request for Continued Examination was 44.4 months. *Id.*

48. *See* U.S. PAT. & TRADEMARK OFF., MPEP § 708.01 (9th ed. Rev. 07.2022, Feb. 2023) (discussing a list of special circumstances under which certain applications may be processed ahead of other applications); *see also Initiatives*, U.S. PAT. & TRADEMARK OFF. (last updated Feb. 8, 2023, 9:14 AM), https://www.uspto.gov/patents/initiatives [https://perma.cc/3WUN-45UZ] (listing expedited procedures for design applications, international applications, and certain categories of technology).

49. 35 U.S.C. § 101.

50. *Id.*

51. 35 U.S.C. § 102.

52. 35 U.S.C. § 112.

53. 35 U.S.C. § 103.

54. *See* Graham v. John Deere Co., 383 U.S. 1, 6 (1966) ("Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available."); KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 402 (2007) ("Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, for patents combining previously known elements, deprive prior inventions of their value or utility.").

55. *See* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208, 218 (2014); *id.* at 217–18 ("We have described step two of this analysis as a search for an 'inventive concept'—i.e., an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" (alteration in original) (quoting Mayo Collaborative Servs. v. Prometheus Lab'ys, Inc., 566 U.S. 66, 72–73 (2012))).

obvious,[56] and there is substantial debate about its role in patent law. Professor Dmitry Karshtedt describes non-obviousness as the most important requirement for patentability because it "serves the key function of weeding out patents on technically trivial inventions and is contested in a large majority of patent cases."[57] Dr. Ofer Tur-Sinai has criticized non-obviousness as favoring more complicated technologies over simpler technologies,[58] while Professors Michael Meurer and Katherine Strandburg have suggested it encourages inventors to pursue "more ambitious . . . research projects than would otherwise be pursued."[59]

In one technology sector, patent seekers saw non-obviousness as such a barrier that Congress acted to create an entirely new form of intellectual property right.[60] In 1984,[61] Congress passed the Semiconductor Chip Protection Act (SCPA),[62] in part to combat widespread, international piracy of semiconductor technology.[63] The SCPA created a unique form of protection for integrated circuits (called a "mask work")[64] because such technology was consistently failing to attain patent protection due to the non-obviousness requirement, while simultaneously failing to qualify for copyright protection.[65] The protection term of a mask work is shorter relative to patents (ten years instead of twenty).[66]

Despite the significant investment and the difficulty of meeting patentability criteria, patents provide an incredibly lucrative opportunity for inventors. This is explored more thoroughly in the following section.

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56. *See* 35 U.S.C. § 103.

57. Dmitry Karshtedt, *Nonobviousness: Before and After*, 106 IOWA L. REV. 1609, 1611 (2021). *But see* Glynn S. Lunney Jr. & Christian T. Johnson, *Not So Obvious After All: Patent Law's Nonobviousness Requirement,* KSR*, and the Fear of Hindsight Bias*, 47 GA. L. REV. 41, 43 (2012) ("Even following *KSR*, however, the nonobviousness requirement remains a pale shadow of its former self. While the 20% of [patent litigation] losses for which obviousness accounted since *KSR* is somewhat above the 15% average in the pre-*KSR* Federal Circuit era, it remains a far cry from the 65% of losses in the pre-Federal Circuit era.").

58. Tur-Sinai, *supra* note 24, at 248.

59. Michael J. Meurer & Katherine J. Strandburg, *Patent Carrots and Sticks: A Model of Nonobviousness*, 12 LEWIS & CLARK L. REV. 547, 549 (2008).

60. Natalie M. Derzko, *Using Intellectual Property Law and Regulatory Processes to Foster the Innovation and Diffusion of Environmental Technologies*, 20 HARV. ENV'T L. REV. 3, 12 (1996).

61. Leon Radomsky, *Sixteen Years After the Passage of the U.S. Semiconductor Chip Protection Act: Is International Protection Working?*, 15 BERKELEY TECH. L.J. 1049, 1056 (2000).

62. 17 U.S.C. §§ 901–914.

63. Radomsky, *supra* note 61, at 1053.

64. *Id.* at 1056.

65. Derzko, *supra* note 60, at 12. Additionally, semiconductors failed to qualify for copyright protection because they did not fall under the traditionally eligible categories, and almost every aspect of such circuits was deemed functional. *Id.*

66. *Id.* at 13 ("The Semiconductor Chip Act created *sui generis* protection for chip designs . . . . A ten-year exclusive marketing period [was] provided.").

B. Patents Reward Inventors with the Opportunity for Exclusive Commercialization

The theory that patents incentivize innovation is based on the proposition that inventions are public goods that are expensive and difficult to make.[67] Absent patent protection, inventors may not have sufficient motivation to invest in the development, production, and distribution of new products because they would not be able to recoup their investment nor protect it from appropriation by "free riders."[68] Thus, patent law provides a market-based incentive to innovate by granting a temporary commercial monopoly, allowing inventors to recoup their costs through "supracompetitive" pricing.[69] The opportunity for supracompetitive pricing is particularly important for incentivizing industries with substantial research and development costs and where commercial scale-up is particularly intensive (e.g., the green technology sector).[70] Furthermore, patents offer proof of potential return on investment that can be critical for small businesses and startups that might otherwise have difficulty obtaining financing.[71]

The patent system's reliance on market incentives is thought to be an advantage because the government utilizes private information to form the basis of a given technology's value.[72] Private information is arguably superior to government-led strategies of market valuation because of the inefficiencies in calculating an invention's downstream value and because the government is susceptible to politicization, rent-seeking, and mismanagement.[73] However, market-based incentives may have difficulty directing innovation in a "socially optimal manner"[74] where market

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67. Burk & Lemley, *supra* note 19, at 1580.

68. Tur-Sinai, *supra* note 24, at 225–26.

69. Daniel J. Hemel & Lisa Ouellette, *Innovation Policy Pluralism*, 128 YALE L.J. 544, 560 (2019) [hereinafter Hemel & Ouellette, *Innovation Policy Pluralism*].

70. Eric Lane, *Building the Global Green Patent Highway: A Proposal for International Harmonization of Green Technology Fast Track Programs*, 27 BERKELEY TECH. L.J. 1119, 1126 (2012) (describing the promise of an increased return on investment as "critical" to the green technology sector.).

71. *Id.* at 1127.

72. Daniel J. Hemel & Lisa Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 327–28 (2013) [hereinafter Hemel & Ouellette, *Beyond the Patents-Prizes Debate*].

73. *Id.* at 327; Tur-Sinai, *supra* note 24, at 226–27 ("Government actors, on the other hand, generally lack such private information that generates market prices, which is the reason government-led strategies are often considered less efficient than the patent system in allocating innovation resources.").

74. Tur-Sinai, *supra* note 24, at 227; *see also* Amy Kapczynski & Talha Syed, *The Continuum of Excludability and the Limits of Patents*, 122 YALE L.J. 1900, 1942 (2013) ("Patents . . . link the

demand does not fully capture the social value of the technology.[75] This means there is a "systematic gap" between the patent value and the social value for technologies with positive externalities.[76]

One scholar has offered a clear high-level example: assume a company is deciding "whether to implement a new technology designed to reduce the amount of greenhouse gas emitted during production."[77] Implementing the technology will directly benefit the company to some degree, but the technology will also indirectly benefit the public by positively impacting the environment. When deciding whether to implement the technology, a profit-maximizing company will likely focus only on the direct costs and benefits of the technology rather than the indirect costs for which there is minimal or no apparent profit. The difference in value between the direct benefits to the company and the indirect benefits to the public is not readily captured by market demand, which means they are also not captured by patent incentives.[78] Put another way, "[r]ational, self-interested producers of knowledge goods will invest only until their *own* marginal benefit equals their marginal cost of production, and they may fail to take into account the benefits that others enjoy from the knowledge."[79] Since some portion of the technology's value is not readily internalized by the investor or business, the market fails to provide an optimal incentive to invest in the technology. This mitigates the attractiveness of patent protection because the patent process is generally expensive and time consuming; a business will only justify the cost of obtaining a patent if it perceives the underlying technology is sufficiently valuable.

II. POSITIVE EXTERNALITIES IN GREEN TECHNOLOGY

Positive externalities play a prominent role in mitigating the effectiveness of patents on green technology innovation. This Part begins by discussing the inability of the patent system to incentivize green technology at an optimal level due to positive externalities. It proceeds by explaining how a patent prize system can mitigate this problem. It

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expected private returns not to social value simpliciter, but rather to the portion of social value that can be effectively (or cheaply) extracted through the exercise of exclusionary rights.").

75. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 575 ("Yet there are numerous reasons that the net present value of future monopoly profits may diverge from the social value . . . . Perhaps most obviously, the relevant knowledge good may generate positive externalities.").

76. Tur-Sinai, *supra* note 24, at 233.

77. *Id.* at 234.

78. *Id.* at 234–35.

79. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 574 (emphasis in original).

concludes with a discussion of the Patents for Humanity Award—an informative example of a patent prize system in place today.

A. Patents' Inability to Sufficiently Incentivize Green Technology

It is well-documented that patent systems fail to adequately incentivize green technology.[80] This is due in part to the inherent market failure for inventions directed toward solving "common pool"[81] issues, like reducing greenhouse gases. Because there is no direct economic incentive to reduce greenhouse gases, the market fails to provide an adequate innovation incentive.[82] Since the value of a patent largely depends on the market demand for the underlying technology, patent systems fail to offer adequate incentives where market demand does not exist.[83]

Even when a market exists, the patent system fails to properly incentivize green technologies due to positive externalities.[84] Positive externalities exist when some portion of the benefits created by a technology "spillover"[85] to third parties;[86] that is, when not all the benefits are internalized by the business that created the technology. When deciding whether to invest in a particular green technology, a profit-maximizing business will likely focus on the technology's direct costs and benefits rather than the additional benefits conferred to third parties.[87] This results in suboptimal investment because the actual value of the benefits of the technology—commercial plus social—was not properly

80. Ebrahim, *supra* note 8, at 115 ("[I]f businesses are not willing to pay for clean and sustainable technologies that reflect their social value, then the patent system may not incentivize development of such technologies to a socially optimal value."); Adler, *supra* note 34, at 3 ("Patent protection provides an insufficient incentive to develop technologies to address common pool problems like global atmospheric pollution . . . ."); Tur-Sinai, *supra* note 24, at 227 ("[I]t is widely understood today that a market-based platform cannot always be trusted to direct innovation in a socially optimal manner."); Ofer Tur-Sinai, *Technological Progress and Well-Being*, 48 LOY. U. CHI. L.J. 145, 157 (2016) ("Another instance where market demand might fail to reflect social value is when the innovation at hand has significant positive externalities."); Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 575 ("[T]here are numerous reasons that the net present value of [patents] may diverge from the social value of a new knowledge good. Perhaps most obviously, the relevant knowledge good may generate positive externalities . . . .").

81. Adler, *supra* note 34, at 3.

82. *Id.* at 4.

83. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 575; Adler, *supra* note 34, at 4.

84. Tur-Sinai, *supra* note 24, at 214; Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 575.

85. Burk & Lemley, *supra* note 19, at 1587.

86. Tur-Sinai, *supra* note 24, at 233–34 n.123.

87. *Id.* at 214.

considered.[88] If the market fails to capture the social value of a given technology, the technology is unlikely to attract an optimal amount of investment concomitant with its actual value.[89] Thus, the value of a patent on the technology will also be suboptimal.[90]

B. Patent Prizes as a Remedy for Positive Externalities

One method that may remedy the issue of positive externalities is a patent prize system (sometimes called a "patent reward").[91] A patent prize is a reward—often, but not exclusively, a monetary award—given to the first individual to meet the reward criteria established by the government.[92] Similar to patent systems, inventors "[i]n a pure prize system"[93] bear both the cost of development and the risk of failure.[94] The difference between patents and prizes, as they relate to innovation incentives, is that market forces determine the value of a patent, while a nonmarket entity (e.g., the government) determines the value of a prize.[95]

Significant scholarship has focused on developing accurate methods for determining prize value.[96] Examples include compensating inventors based on the inventor's expected profit,[97] sales data,[98] auction process,[99] and a mix of private and government estimates.[100] An innovative example of a non-monetary award is found with the Patents for Humanity award, discussed below in section II.C, wherein a successful inventor is awarded

88. *Id.*

89. *Id.*

90. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 575.

91. Mandel, *supra* note 38, at 64.

92. Adler, *supra* note 34, at 12–13. It is important to note that private entities may also establish and award prizes. This Comment focuses on government-set prizes.

93. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 560.

94. *Id*. at 560–61.

95. *Id.*

96. For a thorough review of many of the prominent prize assessment theories, see Michael B. Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115 (2003).

97. Mandel, *supra* note 38, at 64.

98. Steven Shavell & Tanguy Van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 541 (2001).

99. Michael R. Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 Q.J. ECON. 1137, 1138 (1998).

100. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 574 ("[A] system that sets rewards for innovation based on a mix of market and governmental estimates may be likely to stray less drastically in either the overcompensatory or undercompensatory direction relative to social value.").

a certificate for accelerated patent examination.[101] Regardless of the chosen method, the advantage of any prize system is that a nonmarket entity is at least theoretically capable of taking into account not only the market value of the technology but the social value as well.[102] Some suggested prize systems propose that the inventor relinquish their patent rights to the government in exchange for the prize,[103] but this is not necessary to every prize system.[104] Additionally, both patents and prizes are flexible enough in form so that their monetary value can be paid out as either a lump sum or incrementally over time.[105]

Prizes have several advantages over patent systems. As already mentioned, prizes are not necessarily tied to market demand, meaning that they can internalize positive externalities in ways that patents cannot.[106] For example, the market may fail to account for the social value of technologies that generate substantial positive externalities, but a prize established by a government can account for such value.[107] Prizes can also reduce the inefficiency caused by companies expending resources to invent around competitors' patents.[108] Furthermore, they can reduce licensing transaction costs, which can further reduce the risk and cost of

101. *Patents for Humanity*, U.S. PAT. & TRADEMARK OFF. (last updated Mar. 6, 2023, 9:49 AM), https://www.uspto.gov/ip-policy/patent-policy/patents-humanity [https://perma.cc/B3DE-C2U7]

102. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 574–75.

103. *See, e.g.*, Mandel, *supra* note 38, at 64 ("Under a rewards system, the government acquires rights to patentable subject matter that meets the five validity requirements, and in exchange, financially compensates the inventor directly . . . [t]he invention is then made available for use to the general public . . . .").

104. Hemel & Ouellette, *Beyond the Patents-Prizes Debate*, *supra* note 72, at 316 ("U.S. policy typically uses patents as a *complement*, so that innovators may be rewarded through patents *and* prizes . . . .") (emphasis in original); *see* Tur-Sinai, *supra* note 24, at 254 n.244 ("[U]nder U.S. policy, recipients of prizes or direct public funding are generally permitted to seek patent protection as well.").

105. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 560 ("To be sure, patent rents are typically earned over the course of a twenty-year patent life while prizes are typically paid as lump sums, but . . . [p]atentees can choose to sell their monopoly rights for a lump sum at any point (including to government purchasers), and prizes can be paid out incrementally over time.").

106. Tur-Sinai, *supra* note 24, at 253 ("[W]ithin such nonmarket institutional arrangements, there is a greater role for the state in setting and implementing innovation policy, and hence, it is easier to account for environmental considerations. Under such schemes, it is the government—rather than the market—that establishes the criteria for receipt of a reward.").

107. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 555 ("Weighing in favor of government-set rewards, however, is the argument that willingness to pay may be an imperfect proxy for social value. Market institutions may assign a reward that is too low (relative to social value) for knowledge goods that generate positive externalities when consumed, such as low-emission vehicles.").

108. Mandel, *supra* note 38, at 65.

inefficient "patent thickets."[109] Prizes can also eliminate the "deadweight loss" resulting from the noncompetitive pricing of patented inventions (though this implies that the patent is no longer available to the inventor for commercialization purposes).[110]

A patent prize system is not without its disadvantages. Determining the value of inventions is the most obvious difficulty.[111] If the government's compensation model fails to accurately reflect the invention's profitability, inventors will take the risk of commercializing the invention themselves.[112] If the compensation model fails to accurately compensate for the environmental benefit of the invention, then it provides no advantage over the normal patent system from a market demand perspective.[113] This is compounded by the possibility that the government is at an informational disadvantage relative to market actors in establishing commercial value.[114] Moreover, prizes do not typically have as great a commercialization incentive as patents because much of a patent's value is only realized through commercialization (which potentially hinders the distribution of the technology after the prize is awarded).[115] Finally, prize mechanisms require the establishment of clear, concrete goals or particular problems to be solved.[116]

Despite the difficulty of calculating proper compensation, some patent prize models are already in place in several areas.[117] For example, there is already a patent prize system in place for atomic weapons inventions.[118] The Patent Compensation Board sets compensation for inventions related

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109. *Id.* For a discussion of patent thickets, see Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, *in* 1 INNOVATION POLICY AND ECONOMY 119, 119–21 (Adam B. Jaffe et al. eds., 2001); *id.* at 119 (defining a patent thicket as "an overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees").

110. Tur-Sinai, *supra* note 24, at 254 n.244.

111. Mandel, *supra* note 38, at 66; Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 577 ("Even entirely well-meaning government officials may fail to adjust reward size to reflect social value because the information necessary to estimate social value with accuracy is widely dispersed, difficult to compile, and ever evolving.").

112. Mandel, *supra* note 38, at 66; *see also* Hemel & Ouellette, *Beyond the Patents-Prizes Debate*, *supra* note 72, at 307 (discussing how patents may be preferable to prizes when the government is unable to accurately value projects).

113. Mandel, *supra* note 38, at 66; Hemel & Ouellette, *Beyond the Patents-Prizes Debate*, *supra* note 72, at 307.

114. Hemel & Ouellette, *Beyond the Patents-Prizes Debate*, *supra* note 72, at 313.

115. Adler, *supra* note 34, at 17.

116. *Id.* at 17–18.

117. Mandel, *supra* note 38, at 66.

118. 42 U.S.C. § 2181; *see also* Mandel, *supra* note 38, at 66 ("For national security reasons, individuals may not receive patents on atomic energy inventions. Individuals who achieve atomic energy inventions, however, may receive a patent reward.").

to atomic weapons and considers the "actual use" and "importance" of the invention when assessing its value.[119] Additionally, several administrative agencies already employ environmental valuation strategies when balancing the benefits and costs of environmental regulation,[120] suggesting that, while difficult, "[v]aluing the social benefit of environmental innovation is . . . [an] achievable[] task."[121] Lastly, an example of non-monetary compensation is the Patents for Humanity award, which bypasses the difficulty of calculating social benefit by instead awarding a special certificate to expedite the patent process.[122]

C. The Patents for Humanity Award

The Patents for Humanity award is one patent prize system that has experienced some success.[123] Patents for Humanity is the USPTO's "awards competition recognizing innovators who use game-changing technology to meet global humanitarian challenges."[124] Eligible invention categories related to green technology include "sanitation," described as inventions that improve lives by addressing clean water, waste treatment, air pollution, and toxic substances issues, and "household energy," relating to technologies that provide power to "energy-poor homes and communities."[125] The program began as a pilot in 2012, and gained sufficient private and public support to be instituted as an ongoing program in 2014.[126] From 2012 to 2020, thirty-six inventors received the Patents for Humanity award and nineteen received honorable mentions.[127]

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119. 42 U.S.C. § 2187(c); *see also* Mandel, *supra* note 38, at 66 ("Individuals who achieve atomic energy innovations . . . may receive a patent reward. The reward is set by a Patent Compensation Board, based in part upon the actual use and importance of the invention.").

120. Mandel, *supra* note 38, at 66. For examples of statutes requiring cost-benefit analyses when engaging in environmental regulation, see *id.* at 66 n.86.

121. *Id.* at 66.

122. *Patents for Humanity*, *supra* note 101.

123. *Id.*

124. *Id.*

125. *Id.* Other invention categories include "medicine," "nutrition," and "living standards." *Id.*

126. Edward Elliott, *Patents for Humanity: Improving Lives Across the Globe*, WIPO MAG. (Apr. 2017), https://www.wipo.int/wipo_magazine/en/2017/02/article_0003.html%20 [https://perma.cc/9D9T-9NGC].

127. *See Patents for Humanity*, U.S. PAT. & TRADEMARK OFF. (last updated Mar. 6, 2023), https://www.uspto.gov/ip-policy/patent-policy/patents-humanity [https://perma.cc/4KEM-CK89]; *2020 Award Recipients*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/ip-policy/patent-policy/patents-humanity/2020-award-recipients [https://perma.cc/LHJ5-HU6Z]; *2018 Award Recipients*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/ip-policy/patent-policy/patents-humanity/2018-award-recipients [https://perma.cc/AQ6X-6Z95]; *2016 Award Recipients*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/ip-policy/patent-policy/patents-humanity/2016-award-

Examples of clean technology winners include a membrane bioreactor that can recover nutrients, energy, and water from wastewater,[128] and a durable, portable solar light.[129]

Applications are evaluated based on the demonstration of positive real-world impacts on humanitarian issues, and the extent to which the applicants have made available their technologies to other humanitarian researchers—particularly those who work in areas lacking commercial application.[130] Winners of a Patent for Humanity award receive public recognition and an acceleration certificate that may be applied to expedite patent processing of any single matter in the inventor's portfolio or to expedite certain post-grant proceedings before the USPTO.[131] Winners may also transfer their certificates to a third party in exchange for compensation.[132] Allowing certificates to transfer partially shifts the valuation mechanism back to the market, avoiding the complications of the government trying to evaluate the monetary value of the invention.[133] Finally, the Patents for Humanity Award further incentivizes innovation by providing publicity benefits to successful inventors.[134]

Notably, the Patents for Humanity Award is directed toward inventions that are either already approved in the patent application process or are

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recipients [https://perma.cc/XK6R-M3BU]; *2015 Award Recipients*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/ip-policy/patent-policy/patents-humanity/2015-award-recipients [https://perma.cc/L867-D9PL]. Honorable Mention award recipients receive a similar accelerated examination certificate as award winners, but it is not useable for certain forms of post-grant proceedings before the USPTO. *Patents for Humanity*, *supra*.

128. *2020 Award Recipients*, *supra* note 127.

129. *Id.*

130. Edward Kim, *Patents for Humanity*, HARRITY & HARRITY (Dec. 28, 2020), https://harrityllp.com/patents-for-humanity/ [https://perma.cc/D3ZR-K7MU].

131. Patents for Humanity Program, 79 Fed. Reg. 18,670, 18,670 (Apr. 3, 2014) https://www.govinfo.gov/content/pkg/FR-2014-04-03/pdf/2014-07489.pdf [https://perma.cc/ZGP7-7BRT] ("Patents for Humanity certificates . . . can be redeemed to accelerate . . . [a]n *ex parte* reexamination proceeding, including one appeal to the Patent Trial and Appeal Board (PTAB) from that proceeding; a patent application, including one appeal to the PTAB from that application; or an appeal to the PTAB of a claim twice rejected in a patent application or reissue application or finally rejected in an *ex parte* reexamination . . . .").

132. Patents for Humanity Program Improvement Act, Pub. L. No. 116-316, 134 Stat. 5065.

133. Elizabeth Sampson, *Patents for Humanity: The USPTO Recognizes Innovation Relating to COVID-19*, SQUIRE PATTON BOGGS (July 22, 2021), https://www.iptechblog.com/2021/07/patents-for-humanity-the-uspto-recognizes-innovation-relating-to-covid-19/ [https://perma.cc/H5PR-REVN] ("This means that winners can now leverage the acceleration certificate to obtain funds."); Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 576–77 ("[G]overnment-set rewards like grants and prizes may diverge from social value due to failures of the 'political market' . . . [e]ven entirely well-meaning government officials may fail to adjust reward size to reflect social value because the information necessary to estimate social value with accuracy is widely dispersed, difficult to compile, and ever evolving.").

134. Sampson, *supra* note 133.

already patented.[135] Thus, the certificate is not usually available to expedite the review of the particular application that qualifies for the award.[136] The following Part discusses the patent fast-track programs that are, or have been, available to expedite green technology patent applications that are earlier in the examination process.

III. FAST-TRACK PROGRAMS FOR GREEN TECHNOLOGY

Given the urgency of the climate crisis, it is important to consider how Congress and the USPTO have attempted to drive environmental innovation through the patent system. This Part begins by evaluating the success of 37 C.F.R.§ 1.102(c), a statutory fast-track provision directed at environmental technologies. It proceeds by evaluating the success of the Green Technology Pilot Program—a temporary fast-track program that prioritized the review of green technologies. It then analyzes a technology-neutral fast-track program, called "Track One," for green technology participation. It concludes by discussing a new fast-track initiative recently introduced by the USPTO called the Climate Change Mitigation Pilot Program.

A. Accelerated Examination

Patent applications are typically reviewed in the order in which they are filed,[137] unless an applicant files a "petition to make . . . special."[138] If approved, a successful petition can greatly expedite the patent application process.[139] Pursuant to 37 C.F.R. § 1.102, "[a] petition to make an application special may be filed without a fee if the basis for the petition is . . . [t]hat the invention will materially . . . [e]nhance the quality of the environment [or] [c]ontribute to the development or conservation of

135. Patents for Humanity Program, 79 Fed. Reg. 18,670, 18,671 (Apr. 3, 2014), https://www.govinfo.gov/content/pkg/FR-2014-04-03/pdf/2014-07489.pdf [https://perma.cc/7ABB-FFM7] ("Each program application must involve technology that is the subject of one or more claims in an issued . . . patent or a pending . . . patent application . . . . If using a patent application as the basis for the program application, applicants must show that a Notice of Allowance for one or more claims from that patent application has been issued before any certificate will be awarded.").

136. The exception being that award winners may apply the certificate to expedite certain post-grant proceedings, such as ex parte reexamination. *Id.* at 18,670 ("[C]ertificates . . . can be redeemed to accelerate . . . *ex parte* reexamination.").

137. U.S. PAT. & TRADEMARK OFF., MPEP § 708 (9th ed. Rev. 07.2022, Feb. 2023).

138. *Id.* § 708.01.

139. *Id.* § 708.02(a)(VIII)(F) ("The objective of the accelerated examination program is to complete the examination of an application within twelve months from the filing date of the application.").

energy resources."[140] To qualify under this provision, an application must be directed toward improving the environment or conserving energy resources.[141] The application is subject to a cap on the number and type of claims.[142] Applicants must conduct their own search for documents that may affect the patentability of the application (e.g., other closely related inventions and disclosures that may determine whether the application is novel or non-obvious),[143] and provide an examination support document explaining how the invention deviates from those documents.[144] The USPTO refers to this expedited process as "Accelerated Examination."[145]

Generally, the Accelerated Examination Program succeeds in reducing the patent prosecution time for qualifying applications.[146] In 2015, applications filed under 37 C.F.R. § 1.102(c) had an average pendency for first office action of only 5.77 months, compared to 16.1 months through the normal process.[147] Furthermore, the average pendency from filing to patent disposition[148] was just 12.58 months,[149] over twice as fast as through the normal process.[150]

Despite the shortened prosecution time, the Accelerated Examination Program appears to have such minimal participation that the USPTO has

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140. 37 C.F.R. § 1.102(c) (2021).

141. *Id.*

142. U.S. PAT. & TRADEMARK OFF., MPEP § 708.02(a)(I)(E) (9th ed. Rev. 07.2022, Feb. 2023) ("The application must contain three or fewer independent claims and twenty or fewer total claims. The application must also not contain any multiple dependent claims.").

143. *Id.* § 708.02(a)(I)(H) (discussing the requirements for the applicant's pre-examination search).

144. *Id.* § 708.02(a)(I)(I) (discussing the requirements of the examination support document).

145. *Id.* § 708.02(a); *Accelerated Examination*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/patents/initiatives/accelerated-examination [https://perma.cc/W24W-GQZV].

146. The statistical data provided by the USPTO does not distinguish between applications that qualified for Accelerated Examination under the environmental or energy conservation provision, and those that qualified under other provisions (e.g., petitions to make special based on threat of infringement, recombinant DNA, superconductivity materials, HIV/AIDS and cancer, and countering terrorism, and biotechnology applications). This Comment assumes the observed decrease in patent prosecution times applies equally to all technology classes, including environmental applications. *See Accelerated Examination*, *supra* note 145. Of note, 2015 is the most recent data provided on the USPTO website. *Id.*

147. *Id.*; *Patents Pendency Data*, *supra* note 46.

148. It is important to note that a patent disposition is not synonymous with patent issuance. For example, a patent disposition may include applications that were abandoned by the applicant. The USPTO does not distinguish between patents issued versus patents abandoned in this data. *Accelerated Examination*, *supra* note 145.

149. *Id.*

150. *See Patents Pendency Data*, *supra* note 46 (in March 2023, average traditional total pendency was 25.6 months, and average pendency for applications that included at least one Request for Continued Examination was 44.4 months).

sought public comment on whether there is value retaining it.[151] Between 2007 and 2011, the average number of Accelerated Examination petitions per year was under 650.[152] Following implementation of the "Track One" prioritized examination process in 2011 (an alternative accelerated examination procedure),[153] the USPTO began receiving fewer than 200 petitions annually.[154] To put this in perspective, the USPTO has received over 450,000 patent applications through the normal review process every year since 2007, peaking at 621,000 in 2019.[155]

There are many possible reasons why innovators have not taken advantage of this regulation. It is possible that applicants of environmental technology do not wish to expedite review of their invention because prolonged review gives applicants more opportunity to amend their application to better capture developments in the market.[156] Furthermore, prioritizing the review of environmental patent applications[157] may fail to incentivize inventors because the length of time to procure a patent is not a factor contributing to the relatively low (and declining) patent rate of green technologies.[158] Thus, simply reducing the time to procure a patent without addressing the positive externality problem affecting demand does little to spur innovation in the green technology sector.

B. The Green Technology Pilot Program

In 2009, the USPTO initiated a temporary program—called the Green Technology Pilot Program—to expedite "green" patent applications.[159] The program streamlined the review process for "clean technologies, such as environmental quality, energy conservation, development of renewable

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151. Changes in Accelerated Examination Practice, 81 Fed. Reg. 54,564, 54,565 (Aug. 16, 2016), https://www.govinfo.gov/content/pkg/FR-2016-08-16/pdf/2016-19527.pdf [https://perma.cc/DQ27-2HCQ].

152. *Accelerated Examination*, *supra* note 145.

153. *See infra* section III.C.

154. Changes in Accelerated Examination Practice, *supra* note 151.

155. *U.S. Patent Statistics Chart*, U.S. PAT. & TRADEMARK OFF. (last updated May 30, 2023), https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm [https://perma.cc/X6CE-K39T].

156. Michael Gollin, *Using Intellectual Property to Improve Environmental Protection*, 4 HARV. J.L. & TECH. 193, 212 (1991).

157. Derzko, *supra* note 60.

158. Urbaniec et al., *supra* note 8, at 8–9 (demonstrating a decline in environmental patent rates in the United States from 2013 to 2017, as measured by multiple metrics).

159. *Green Technology Pilot Program—CLOSED*, U.S. PAT. & TRADEMARK OFF. (last updated Aug. 11, 2022), https://www.uspto.gov/patents/initiatives/green-technology-pilot-program-closed#:~:text=The%20Green%20Technology%20Pilot%20Program%20provided%20for%20applications%20pertaining%20to,support%20document)%20or%20the%20Prioritized [https://perma.cc/GP9L-ZQVK]; Lane, *supra* note 70, at 1140.

energy resources, and greenhouse gas emission reductions."[160] In effect, qualifying patent applications were advanced to the front of the line for substantive review, potentially reducing the time before a patent was issued.[161] The program was initially scheduled to terminate after one year or 3,000 petitions were filed, whichever occurred first, but was extended twice due to lower-than-expected participation.[162] Ultimately, the program concluded in February of 2012 when it reached its petition limit.[163]

Generally, the Green Technology Pilot Program contained most of the same substantive application requirements as Accelerated Examination under 37 C.F.R. § 1.102(c),[164] including a cap on the number and type of claims.[165] The program was only available for applications filed before initiation of the program and that had not received a first office action (i.e., applications which were already filed, but that the USPTO had not begun to examine).[166] Newly-filed applications were ineligible.[167] However, the Green Technology Pilot Program departed from the Accelerated Examination Program in several ways.

Unlike the Accelerated Examination program, the Green Technology Pilot Program did not require applicants to perform their own prior art search.[168] Additionally, while the categories of inventions that qualified for the Green Technology Pilot Program appeared to be similar to those of 37 C.F.R. § 1.102(c)[169] the USPTO initially interpreted the program's language very narrowly, causing "the vast majority of green tech petitions [to be] denied."[170]

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160. U.S. PAT. & TRADEMARK OFF., USPTO PATENT EXAMINATION ACCELERATION PROGRAMS AND PROPOSALS 2, https://www.uspto.gov/sites/default/files/patents/process/file/accelerated/comp_chart_dom_accel.pdf [https://perma.cc/K4J5-JSEN]; Lane, *supra* note 70, at 1140.

161. Lane, *supra* note 70, at 1140.

162. *Id.* at 1143.

163. *Id.* The petition limit was increased from 3,000 to 3,500 at the end of 2011. *Id.*

164. USPTO PATENT EXAMINATION ACCELERATION PROGRAMS AND PROPOSALS, *supra* note 160.

165. *Id.*

166. Lane, *supra* note 70, at 1140–41.

167. *Id.*

168. USPTO PATENT EXAMINATION ACCELERATION PROGRAMS AND PROPOSALS, *supra* note 160.

169. To qualify for the Green Technology Pilot Program, the technology had to be "directed to environmental quality, conserving energy, developing renewable energy resources, or reducing greenhouse gas emissions." Lane, *supra* note 70, at 1141. This is compared to the language in 37 C.F.R. § 1.102(c) stating that the invention has to "materially . . . [e]nhance the quality of the environment [or] [c]ontribute to the development or conservation of energy resources." 37 C.F.R. § 1.102(c) (2021).

170. Lane, *supra* note 70, at 1142 ("[T]he most common ground for denial was that the patent

The Green Technology Pilot Program succeeded in reducing the patent prosecution time for applications accepted into the program.[171] The average time between acceptance of a patent application and a first office action was reduced to just sixty-eight days—over thirteen times faster than through the normal review process.[172] Furthermore, applicants filed an average of approximately 213 petitions each month for the duration of the program.[173] In contrast, the USPTO's Accelerated Examination Program averaged approximately seventy-three petitions each month from August 2006 to April 2012.[174] This meant the Green Technology Pilot Program had at least three times the rate of petitions as the Accelerated Examination Program despite the initial restrictions on qualifying technologies.[175]

Despite the reduced prosecution times and relative popularity compared to the Accelerated Examination Program, the Green Technology Pilot Program had relatively limited participation when compared to overall patent rates.[176] From December 2009 to March 2012, the program received approximately 1,514 applications per year.[177] In that same period, approximately 18,421 green technology patent applications and 414,362 total patent applications were filed.[178] This equates to a fast-track usage rate of 8.22% when compared to the normal patent process for green technology patents.[179]

Scholars have offered several explanations for the low participation

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application was not in an eligible technology class and subclass. This was, at least in part, because the universe of eligible classes and subclasses represented only a subset of technology that is actually green."). This restriction was eventually loosened to encourage more participation. *Id.*

171. Gattari, *supra* note 40, at 44.

172. *Id.*

173. *See* U.S. PAT. & TRADEMARK OFF., GREEN PETITION REPORT SUMMARY (2012), https://www.uspto.gov/sites/default/files/patents/init_events/green_report_summary20120426.pdf [https://perma.cc/9RX8-T9DW] (5,550 petitions received over course of program).

174. *See* U.S. PAT. & TRADEMARK OFF., ACCELERATED EXAMINATION STATISTICS (2012), https://www.uspto.gov/sites/default/files/patents/process/file/accelerated/ae_petition_status_2012apr09.pdf [https://perma.cc/LB98-22Y8] (4,996 petitions filed over approximately 68 months). Notably, this data includes petitions from all technology classes, not just green technology petitions. Thus, it is likely the difference in green technology participation is even greater than indicated by these numbers alone.

175. Tran, *supra* note 15, at 146–47.

176. *See* Antoine Dechezleprêtre, *Fast-Tracking Green Patent Applications: An Empirical Analysis*, INT'L CTR. FOR TRADE & SUSTAINABLE DEV. 6 (Feb. 2013), https://www.files.ethz.ch/isn/161230/fast-tracking-green-patent-applications-an-empirical-analysis.pdf [https://perma.cc/664J-6TQF].

177. *Id.* at 6.

178. *Id.* at 7.

179. *Id.*

rate. One argument is that the program was too short-lived.[180] The inventive process may take much longer than a year—the originally intended duration of the program—meaning many inventors would not have enough time to respond to the program's incentives (once the program was expanded to allow for new applications).[181] Thus, the program's temporary nature may have discouraged practitioners from expending time and resources learning a system that was unlikely to persist.[182]

In addition to the program's temporary nature, a lack of coordination between the Green Technology Pilot Program and similar fast-track programs in other countries may have created an undue burden on practitioners seeking to apply to multiple fast-track programs.[183] Specifically, there was wide variability in the permitted categories of technologies, the number of claims allowed, and whether the applicant had to perform a prior art search.[184] These differences likely increased the time and cost investment for inventors seeking to take advantage of international fast-track programs,[185] causing them to rely on more stable patent processes that lacked green technology prioritization.[186]

Finally, it is possible that the Green Technology Pilot Program simply suffered from the same problem as 37 C.F.R. § 1.102(c): that merely shortening prosecution time is insufficient to incentivize green technology innovation, particularly without addressing the positive externality problem.[187]

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180. Lane, *supra* note 70, at 1156.

181. Tran, *supra* note 15, at 152–53 ("An incentive to invent a new technology exists only if an inventor is aware of an opportunity that will benefit [them] as a result of the invention. The Green Technology Pilot Program did not create any such opportunities. . . . Even though the PTO later expanded the program to include applications filed after the initial period ended, the program still fail[ed] to provide an incentive for innovation as it [was] set to expire little more than a year after the expansion took effect.").

182. Kate Nuehring, *Our Generation's Sputnik Moment: Comparing the United States' Green Technology Pilot Program to Green Patent Programs Abroad*, 9 NW. J. TECH. & INTELL. PROP. 609, 618 (2011).

183. Lane, *supra* note 70, at 1147 ("When viewed as a whole, the most serious problem with the green patent fast track programs is the wide variability in their rules.").

184. *Id.* at 1137–45.

185. Dechezleprêtre & Lane, *supra* note 23.

186. *See id.* ("These disadvantages explain why only a small percentage of eligible patent applications are submitted to fast-track programs. . . . Most applicants therefore have an incentive to wait until the examination is conducted under the regular procedure.").

187. Tur-Sinai, *supra* note 24, at 214, 250 n.220.

C. Track One—The Prioritized Examination Program

The USPTO introduced the Prioritized Examination Program, also referred to as "Track One,"[188] in 2011.[189] Prioritized Examination is codified under 37 C.F.R. § 1.102(e),[190] and contains many of the same substantive requirements as the Accelerated Examination Program (for example, applications are restricted in the number and type of claims allowed).[191] However, any technology can qualify for Prioritized Examination as long as it meets form and fee requirements; there is no carve-out specific to environmental or energy conservation applications.[192] Furthermore, applicants using Prioritized Examination do not need to perform their own prior art search, nor provide a support document detailing the differences between the invention and prior art.[193] As of February, 2023, the Prioritized Examination Program was capped at 15,000 applications annually.[194] The average time from application to first office action is two months, [195] compared to 16.1 months through the normal process.[196] The average time from application to final disposition is 5.4 months,[197] significantly faster than the two to four years through the normal process.[198]

Participation in the Prioritized Examination Program appears relatively

188. U.S. PAT. & TRADEMARK OFF., MPEP § 708.02(b) (9th ed. Rev. 07.2022, Feb. 2023); *USPTO's Prioritized Patent Examination Program*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/patents/initiatives/usptos-prioritized-patent-examination-program [https://perma.cc/J76E-4NW2].

189. *USPTO's Prioritized Patent Examination Program*, *supra* note 188; Changes to Implement the Prioritized Examination Track (Track I) of the Enhanced Examination Timing Control Procedures Under the Leahy-Smith America Invents Act, 76 Fed. Reg. 59,050, 59,050 (Sept. 23, 2011) (to be codified at 37 C.F.R. pt. 1), https://www.uspto.gov/sites/default/files/patents/init_events/track1-aia.pdf [https://perma.cc/444B-33F4].

190. 37 C.F.R. § 1.102(e) (2021).

191. U.S. PAT. & TRADEMARK OFF., MPEP § 708.02(b) (9th ed. Rev. 07.2022, Feb. 2023).

192. *Cf. id.* (providing no carve-out specifically for environmental or energy conservation applications).

193. *Cf. id.* (providing for no prior art search or supporting document requirements).

194. *USPTO's Prioritized Patent Examination Program*, *supra* note 188.

195. *Patent Track One Data March 2023*, U.S. PAT. & TRADEMARK OFF. (last updated Apr. 20, 2023, 12:12 PM), https://www.uspto.gov/dashboard/patents/track-one.html [https://perma.cc/WYX3-Z3BJ].

196. *Patents Pendency Data*, *supra* note 46.

197. *Patent Track One Data*, *supra* note 195.

198. *Patents Pendency Data*, *supra* note 46 (in March 2023, average traditional total pendency was 25.6 months, and average pendency for applications that included at least one Request for Continued Examination was 44.4 months).

robust.[199] From 2015 to 2017, the annual number of applications was approximately 9,000, just short of the 10,000 cap in place during that period.[200] In 2019, the USPTO increased the cap to 12,000, and participation peaked at over 11,000.[201] While still a relatively small proportion of total applications annually, the fact that the USPTO has felt the need to increase the cap limit at least twice in ten years[202] suggests that petitioners are eager to use the program.

While the Prioritized Examination Program appears both generally popular and effective at reducing examination times, it is difficult to determine whether green technology applications are taking advantage of this process—in part because "green technology" can refer to a broad range of technologies.[203] The technology types that most prevalently use the program include biotechnology, organic chemistry, transportation, e-commerce, construction, agriculture, mechanical engineering, manufacturing, gaming, and medical devices.[204] Many patent applications classified under these technology sectors may also be green applications, but that data is not presently available.

Because Prioritized Examination simply reduces the time it takes the USPTO to review a patent application, the same incentivization problems facing green technology persist. For example, green technology applicants may not desire expedited review because the commercial market for such technology is still developing and prolonging the application process allows applicants to amend their claims to better capture the developing market.[205] Furthermore, Prioritized Examination does not consider the problem of positive externalities. Prioritized Examination is no more designed to address these concerns than the Accelerated Examination Program, or the Green Technology Pilot Program.

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199. *See* Parker Brogdon, *Ten Years of Track One: Is It Still Worth It? (2021 Report)*, JURISTAT (July 28, 2021), https://blog.juristat.com/track-one-2021 [https://perma.cc/5BTP-Q4QV].

200. *Id.*

201. *Id.*

202. 2021 Increase of the Annual Limit on Accepted Requests for Track One Prioritized Examination, 86 Fed. Reg. 52,988, 52,988 (Sept. 24, 2021) (to be codified at 37 C.F.R. pt. 1), https://www.govinfo.gov/content/pkg/FR-2021-09-24/pdf/2021-20530.pdf [https://perma.cc/4TKC-7ENY] ("The America Invents Act provides that the [USPTO] may not accept more than 10,000 requests for prioritization in any fiscal year . . . . The [USPTO] published an interim rule in 2019 . . . increasing the limit on the number of . . . requests that may be accepted in a fiscal year to 12,000. The current interim rule further . . . increas[es] the limit on the number of . . . requests that may be accepted in a fiscal year to 15,000.").

203. *See* Lane, *supra* note 70, at 1163.

204. Brogdon, *supra* note 199.

205. *See* Gollin, *supra* note 156, at 212.

D. The Climate Change Mitigation Pilot Program

On June 3, 2022, the USPTO announced a new fast-track program—called the Climate Change Mitigation Pilot Program—oriented toward expediting climate-focused technology applications.[206] Applications must be directed toward technologies that mitigate climate change and are designed to reduce greenhouse gas emissions.[207] The program is designed to run until June 5, 2023, or when 1,000 applications have been accepted, whichever occurs first.[208]

Substantively, the Climate Change Mitigation Pilot Program appears to replicate many of the lasting[209] application requirements of the Green Technology Pilot Program. For example, the number and types of claims are limited,[210] and the applicant need not perform a prior art search or provide an examination support document.[211] The Climate Change Mitigation Pilot Program appears open to new applications as well, rather than those already filed but that have not been taken up for review.[212]

Because this program is relatively new, there is little data available to assess whether participation will be robust, and how much faster it is than the normal patent process. However, initial statistics are somewhat underwhelming.[213] Though it could simply be that the program has not been in place long enough for inventors to become aware of it, it seems likely that some of the same issues that depressed participation in the Green Technology Pilot Program are similarly at play. For example, the Climate Change Mitigation Pilot Program is thus far advertised as temporary, lasting for just over a year at most.[214] Practitioners may be inclined to simply stick with the existing patent processes they are already familiar with, rather than expend time and resources familiarizing

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206. Climate Change Mitigation Pilot Program, 87 Fed. Reg. 33,750, 33,750 (June 3, 2022), https://www.govinfo.gov/content/pkg/FR-2022-06-03/pdf/2022-11930.pdf [https://perma.cc/LG6W-8U8A]; *Climate Change Mitigation Pilot Program*, U.S. PAT. & TRADEMARK OFF. (Mar. 8, 2023), https://www.uspto.gov/patents/laws/patent-related-notices/climate-change-mitigation-pilot-program [https://perma.cc/L89U-45PH].

207. Climate Change Mitigation Pilot Program, 87 Fed. Reg. at 33,752.

208. *Id.* at 33,751.

209. Several of the initial requirements of the Green Technology Pilot Program were either abandoned or expanded partway through the Program. *See supra* section III.B.

210. *See* Climate Change Mitigation Pilot Program, 87 Fed. Reg. at 33,752; *supra* section III.B.

211. Climate Change Mitigation Pilot Program, 87 Fed. Reg. at 33,751.

212. *Id.*

213. As of March 7, 2023, only 253 petitions had been filed, and 165 had been granted. At the current rate, the program is likely to conclude on June 5, 2023, having hit less than one quarter of its cap. *Id.*

214. *Id.*

themselves with a new fast-track program.[215] Of course, the problem of positive externalities continues to persist as well.

IV. A MULTI-PRONGED APPROACH TO GREEN TECHNOLOGY INNOVATION

The patent process needs a multi-pronged approach to incentivize green technology innovation. This section explores reintroduction of an improved fast-track program for green patents that mitigates past shortfalls, and then turns to the creation of a prize system structured to complement the fast-track program. This Part begins by arguing that despite low participation in the past, a green technology-specific fast-track program should be reintroduced to provide a rapid pathway for green technology patents as the green technology market develops. Next, this Part recommends implementing a green technology patent prize system that borrows elements from the Patents for Humanity award. It concludes by advocating for a complimentary patent-prize structure designed to incentivize green technology that is both high- and low-tech, and that has varying levels of market demand.

A. The United States Should Reinstate an Improved Green Technology Fast-Track Program

The Green Technology Pilot Program was a well-intentioned attempt by the United States to incentivize green technology innovation and demonstrate a commitment to addressing the growing climate crisis.[216] Unfortunately, the subject matter restrictions (at least initially) and temporary nature of the program likely reduced its attractiveness to inventors and practitioners.[217] The Climate Change Mitigation Pilot Program appears to carry on the good intent of the Green Technology Pilot Program but it likely suffers from similar structural flaws. Furthermore, merely reducing the time and cost to prosecute a green technology patent may be insufficient to drive meaningful innovation given the presence of positive externalities.

While the patent system itself may be unable to address the problem of positive externalities, this Comment argues that the foundation of a green technology patent-prize scheme should start by relying on the innovation advantages inherent to the patent system. These advantages include (1) allowing the market to drive the technology's commercial value

215. *See* Nuehring, *supra* note 182, at 618.

216. *See supra* section III.B.

217. *See* Lane, *supra* note 70, at 1155–56.

because of the informational advantage market actors have over government-actors;[218] and (2) the drive to commercialize inherent in the patent system, potentially increasing the rate of diffusion of the technology.[219]

Moreover, given the unique urgency of the climate crisis, a green technology fast-track program should be made available to facilitate as rapid development and diffusion of technology as possible. Using the lessons from the Accelerated Examination Program, the Green Technology Pilot Program, the Track One Program, and the Climate Change Mitigation Pilot Program to inform the analysis, there are substantive changes that can be made to establish a useful fast-track program that does not unnecessarily mitigate the attractiveness of such an option to inventors and upon which a green technology prize system can be built.

Subject matter restrictions must be properly balanced to capture as many green technologies as possible without encompassing technologies that have little environmental impact.[220] A strong starting point may be expanding the climate-focused subject matter requirements of the Climate Change Mitigation Pilot Program to further allow any invention that confers a "material environmental benefit."[221] Such a broad requirement is justified because green technology covers a broad assortment of possible technologies.[222]

The temporary nature of the Green Technology Pilot Program may also have discouraged participation,[223] thus limiting its ability to foster green innovation.[224] This is because the inventive process can be lengthy—

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218. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 555 ("Government-set rewards entail an informational burden that bureaucrats may be ill equipped to handle, even with mechanisms like peer review and expert panels for consolidating information. Markets, by contrast, aggregate widely dispersed information regarding consumers' willingness to pay for new knowledge goods.").

219. *See* Adler, *supra* note 34, at 17 ("The patent holder's reward comes from turning the patent invention into a commercially saleable product.").

220. Lane, *supra* note 70, at 1163.

221. *Id.* at 1166.

222. Ebrahim, *supra* note 8, at 114 ("[C]lean technology has been defined by the United Nations as energy-generating technologies that have the potential for reducing greenhouse gases. Clean technology refers to measures taken to reduce or eliminate at the source of production any nuisance, pollution, or waste, and to help save raw materials, natural resources, and energy, thereby increasing performance, productivity, or efficiency by minimizing negative effects on the environment. Sustainable technology refers to the design of chemical products that offer environmentally friendly alternatives; these sustainable technologies can either prevent waste, are less toxic, use renewable feedstock, use safer solvents and reaction conditions, or increase energy efficiency.").

223. *See* Lane, *supra* note 70, at 1156.

224. Tran, *supra* note 15, at 152–53.

likely longer than the run time of the program.[225] The short term of the program also meant that practitioners were unlikely to devote resources to figuring out how to operate through a program that was unlikely to persist.[226] Reintroducing a fast-track program will necessarily require letting it run much longer than the three years of the Green Technology Pilot Program if the program is to have a meaningful effect on innovation.[227]

The limited participation of green technology in multiple different prioritization schemes that differ in form and subject matter requirements suggests that merely shortening the length of patent prosecution may not be a major factor in incentivizing green technology.[228] Thus, to be attractive, a fast-track program may need to do more than just reduce the time to patent issuance. One possibility is to include changes to the substantive review applied by examiners, and to provide a correspondingly altered patent term.[229]

For example, relaxing the non-obviousness criterion may unlock protection for a broad swath of low-technology environmental innovation.[230] Congress demonstrated a willingness to institute a statutory solution to a partial non-obviousness issue for semiconductor chips by creating a "mask work" in 1984 via the Semiconductor Chip Protection Act (SCPA).[231] While this Comment does not recommend creating a novel form of protection like a mask work, it does suggest that a statutory solution is a viable option, especially given the proximity of the climate crisis and the steady decline of green technology innovation over the last ten years.[232] Because a weaker standard of patent review applies, a shorter

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225. *Id.* at 153.

226. *See* Nuehring, *supra* note 182, at 618.

227. Ideally the program should be permanent so as to best mitigate the potential depressive effect on participation. *See id.*

228. Mandel, *supra* note 38, at 62 ("The research and development costs, and time devoted to most environmental innovation, likely substantially exceed the delays and expense of patent prosecution. Consequently, improvements through streamlining patent prosecution would not significantly increase incentives for environmental innovation. Nor would they internalize the positive externalities of environmental benefit.").

229. Derzko, *supra* note 60, at 14.

230. Tur-Sinai, *supra* note 24, at 247–48; Derzko, *supra* note 60, at 14 ("Removing the non-obvious requirement would allow incremental changes in environmental technology to be protected.").

231. 17 U.S.C. §§ 901–914.

232. *See* Mountford et. al, *supra* note 1; Urbaniec et al., *supra* note 8, at 8–9 (demonstrating a decline in environmental patent rates in the United States from 2013 to 2017, as measured by multiple metrics); *see also* Derzko, *supra* note 60, at 14 ("Given the lack of environmental technology development and given its importance, Congress should consider directly addressing the problem by

term of protection may be justified.[233] While inventors of complicated, high-tech green technology inventions may elect to pursue the slower, more rigorous standard patent review process, a shorter, weaker patent alternative can create a "steady rate of innovation" in the environmental sector for low-tech innovation.[234]

It is important to emphasize that the SCPA is just one example of Congressional action directed to a very specific technological field.[235] Simply copying the exact mechanism of the SCPA for use in green technology is unlikely to be particularly useful. But the concept of altering substantive aspects of the review process and the patent term is still informative,[236] especially if such alterations are left to the discretion of inventors, as discussed in section IV.C below.

B. The United States Should Implement a Targeted Patent Prize System

A patent fast-track program by itself is unlikely to achieve the rate of innovation needed because of positive externalities. To that effect, this Comment proposes that Congress introduce a patent prize system dedicated to green technology.[237] Allowing the government to supplement the market-set value of a patent with its own calculation of social value may account for positive externalities while simultaneously leveraging the market actor's superior knowledge of their invention's commercial value.[238] Ideally, the government will not have to calculate the value of the patent itself; only the social value will need to be considered. While there are many possible forms for a patent prize system, this Comment argues for a two-part prize consisting of (1) a monetary incentive, and (2) a special certificate that can substantively affect the patent review process. Such a system will offer the most flexibility for inventors and has the potential to maximize the incentive effect on green technology

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introducing new legislation that would be specifically formulated for environmental technology. This new legislation could be used to avoid both the procedural and substantive patenting difficulties and thereby provide proper innovation incentives to industry.").

233. Derzko, *supra* note 60, at 14.

234. *Id.* at 15.

235. *Id.* at 12–13.

236. *Id.* at 14.

237. The specific qualification criteria for such a program are beyond the scope of this Comment. The Patents for Humanity Award may provide a firm starting point, though it is important that the qualification criteria for the prize and the fast-track program be aligned, since both opportunities must work in tandem to adequately drive innovation.

238. *See* Adler, *supra* note 34, at 15 ("While patent protection provides a background inducement for all commercially marketable innovations, prizes augment the reward for types of innovations that have been identified, ex ante, as having particular social value.").

innovation.

To maximize the effectiveness of the monetary award, the government will need to carefully and accurately establish the social value of the technology.[239] The government will likely need to rely on an administrative group to perform such valuation.[240] The government already relies upon one such agency, the Patent Compensation Board, for similar calculations.[241] This agency's calculation schemes may be informative when establishing a compensation scheme that appropriately accounts for positive externalities.

The exact manner of this monetary compensation can be highly variable. The simplest form is a lump sum paid to the inventor upon satisfaction of the prize criteria. Other possibilities include the government promising to purchase the subsequent patent (if it should issue).[242] Alternatively, the government may enter into an agreement to purchase some amount of the green technology end products at market rate.[243] Depending on the nature of the technology, a continuous payment based on government-set climate goals may be appropriate (e.g., a set amount of dollars per year for each unit of carbon emissions reduced). The wide breadth and variability of green technology demands that a flexible arrangement of compensation models be available to best suit the given technology and thus provide the greatest overall innovation incentive.

Assuming an inventor satisfies the prize criteria, they may also be entitled to a special certificate that can substantively alter the patent review process. Such a certificate would allow inventors to indicate in their subsequent patent application whether to adopt a relaxed non-obviousness review standard, at the expense of a shortened patent term. If the inventor desires instead to apply under normal patentability criteria (and thus receive the normal twenty-year patent term), they can transfer the certificate to a third party in exchange for compensation.[244] This would

239. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 576 ("[G]overnment-set rewards like grants and prizes may diverge from social value due to failures of the 'political market.'").

240. Mandel, *supra* note 38, at 66 ("The primary, potential, new difficulty that a patent rewards system introduces is that an administrative body will have to determine the value of inventions whose owners chose patent rewards.").

241. 42 U.S.C. § 2187.

242. Mandel, *supra* note 38, at 64.

243. Hemel & Ouellette, *Innovation Policy Pluralism*, *supra* note 69, at 594 (discussing that such a system exists today with the Medicaid program).

244. It is acknowledged that allowing transferability of a relaxed criterion certificate effectively opens the program up to any type of invention, rather than just green technology. One possibility that may ameliorate this issue is to make the relaxed non-obviousness criterion only available to the prize-winner; the certificate would then be designed to operate in an alternate manner for third-party

operate quite similarly to the Patents for Humanity model, with the main difference being that the certificate affects the substantive review by the USPTO. If the inventor decides to sell the green technology prize certificate, this income functionally operates as additional monetary compensation for the inventor. If the inventor decides instead to use the certificate, they are afforded an added degree of flexibility in their pursuit to commercialize the technology.

C. The Inventor Should Choose How to Connect the Prize to the Patent

This framework establishes a series of choices for inventors of green technology. First, the inventor will have the option to seek a patent through a targeted fast-track process, or through the normal review process. Next, the inventor will get to decide what social value compensation model they believe is ideal. Last, they have the option of using a special certificate to obtain a relaxed-review, shorter-term patent, or they may transfer the certificate for additional compensation. The ultimate purpose of this framework is to establish a rapid patent process for green technology patents that accounts for positive externalities and grants inventors a large degree of freedom to tailor the prize to their particular invention. Because green technologies include a wide range of both high- and low-technologies (with a wide range of commercial opportunities),[245] the system needs significant flexibility if there is to be sufficient incentive for innovation. This framework leverages the advantages of both a patent and a prize system into a cohesive innovation scheme.

A series of high-level examples clarifies how this framework would operate in practice: (1) An inventor has a green technology invention that does not meet patentability criteria, but which nonetheless satisfies the prize criteria. The inventor still benefits from the government's assessment of the invention's social value, and the special certificate's value should they choose to sell it. (2) An inventor has a low-tech green invention that had minimal research and development costs and for which there is a well-developed market demand. The inventor may favor a fast-track, relaxed non-obviousness review standard with a shortened patent term because the commercial market is well-developed now, and the

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purchasers (e.g., upon transfer, the certificate shifts to providing a fast-track benefit rather than a relaxed criterion benefit, more like the Patents for Humanity Award). See *supra* section II.C for a discussion of the fast-track benefit of the Patents for Humanity award certificate.

245. Hall & Helmers, *supra* note 16, at 510 ("The underlying technology behind green innovations differ greatly, and range from high-tech innovations such as genetically modified crops to low-tech innovations such as mechanical farming techniques.").

invention is unlikely to pass the non-obviousness criteria of the normal review process. The inventor benefits from the social value of the monetary prize, and from the limited patent monopoly that would have been otherwise closed to them. (3) An inventor has a high-technology green invention that incurred extensive research and development costs. The inventor may favor a normal review process (not fast-track) and normal patentability criteria to maintain the longer patent term. The inventor benefits from the social value of the monetary prize, as well as the value of the special certificate if they choose to sell it.

CONCLUSION

There is an urgent need for the rapid development of clean, green, and sustainable technologies. The patent system plays a valuable role in incentivizing technological innovation, but it has shortfalls when applied to green technologies because of the inability of market demand to capture significant positive externalities. Though the Green Technology Pilot Program (and more recently, the Climate Change Mitigation Pilot Program) was a well-intentioned attempt to spur green technology innovation, its structural flaws likely doomed any hope of making the program permanent.[246]

Furthermore, simply reducing the cost of obtaining a patent does not address the underlying issue of significant positive externalities.[247] A patent prize system can capture the value of significant positive externalities by allowing the government to provide a reward enhanced beyond the value captured by market demand. This Comment argues for a two-part prize consisting of (1) a monetary incentive, and (2) a special transferrable certificate that can be used to substantively affect the patent review process by relaxing the non-obviousness criterion. Such a system will offer the most flexibility for inventors and has the potential to maximize the incentive effect on green technology innovation. Inventions granted pursuant to the certificate would be granted a shorter patent term than through the normal review process.

To reach the needed level of green technological development in the shortest time possible, a multi-pronged approach involving both a green technology fast-track program and a green technology patent prize system is required. An improved fast-track program developed with the successes and failures of past and existing fast-track programs in mind, paired with a prize system to account for positive externalities, would allow for the rapid development and distribution of many low-tech green and clean

246. *See supra* section III.B.

247. *See* Tur-Sinai, *supra* note 24, at 214.

technologies. Operating in tandem and connected by an "inventor's choice" certificate, these two programs can create a successful incentive system for green technologies to help combat the climate crisis.